

JOURNAL
OF THE
BOMBAY NATURAL
HISTORY SOCIETY

1970 DECEMBER

Vol. 67

No. 3

Observations on the Nilgiri Tahr
(*Hemitragus hylocrius* Ogilby, 1838)

BY

GEORGE B. SCHALLER

New York Zoological Society

(With two plates and four text-figures)

The *Hemitragus* wild goats differ in appearance from those belonging to the genus *Capra* in that males have no beard and the short horns of males and females differ only slightly in size (Lydekker 1898). Three species of tahr are generally recognized. The Arabian tahr (*H. jayakari*) occurs in the mountains of Oman in Arabia and its habits remain unknown (Fitter 1968). The Himalayan tahr (*H. jemlahicus*) ranges along the southern slopes of the Himalayas from Kashmir to Bhutan (Burrard 1925), and the Nilgiri tahr (*H. hylocrius*) is confined to the hills of south India. Various aspects of the biology of the Himalayan tahr have been studied in New Zealand where the species has been introduced (Anderson & Henderson 1961; Caughley 1965, 1966), but information on the Nilgiri tahr, or 'ibex' as it is known locally, consists chiefly of hunting accounts (Shakespeare 1862; An Old Shikarri 1880; Hawkeye 1881; Hamilton 1892; Pollock 1894; Russell 1900; Fletcher 1911; Stockley 1928) or of brief descriptions of encounters with the animal (Hornaday 1885; Brown 1960; Bassett 1964; Willet 1968). The limited knowledge about the Nilgiri tahr has been summarized by Blandford (1888-91) and Prater (1965). Information about it is needed because its limited distribution and low numbers have qualified it for inclusion into THE RED BOOK of the world's threatened species (Fisher *et al.* 1969). To gather data on the status, distribution, and biology of the Nilgiri tahr, I spent September 26 to November 14, 1969, in south India.

The Nilgiri tahr is a stocky goat in which both sexes have a short, coarse pelage and a bristly mane a few centimetres long, in contrast to the male Himalayan tahr which has a long, shaggy mane on the shoulders, throat and chest. The pelage of subadults, females, and young males is dusky brown to grey-brown in colour except for a whitish abdomen and a dark brown band that runs down the length of the back. There is also a conspicuous dark spot just above the carpal joint or knee. The horns curve sharply backwards and are about 30 cm. long in females (Plate 2). The front of the horn of the Nilgiri tahr is almost flat with the keel confined to the inner edge, whereas the horn of the Himalayan tahr has a prominent keel in front (Fig. 1).

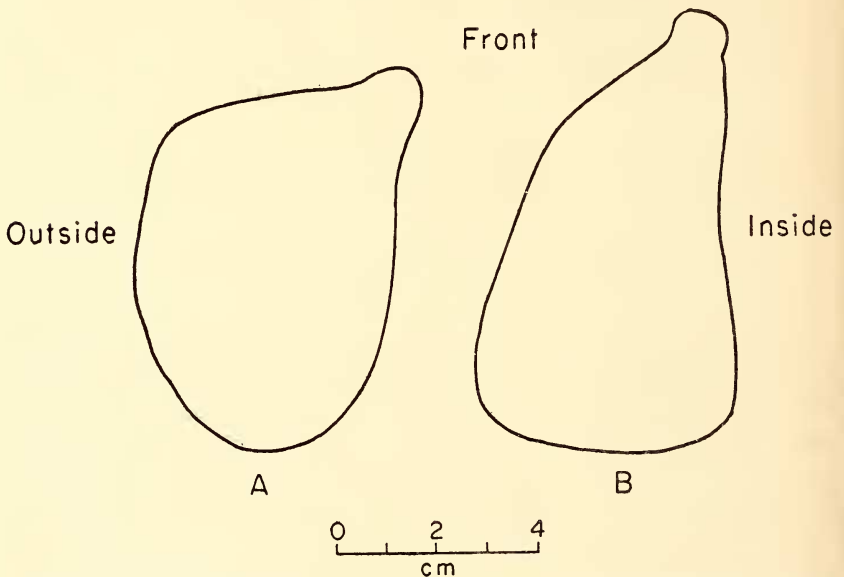


Fig. 1. Cross-sections of tahr horns, taken near the base, showing characteristic shape of (A) the Nilgiri tahr and (B) the Himalayan tahr.

Adult males are handsome creatures, weighing an estimated 80-100 kg. and standing about 100 cm. tall at the shoulders, considerably larger than the females. Their pelage is dark brown, almost black, except for their grizzled white lower back, sides, and sometimes also the rump, a feature responsible for their being called 'saddlebacks' by sportsmen. The sides of the neck, too, are often grey. The abdomen and throat are white, and a pale streak runs from each ear down the side of the muzzle and a light-coloured ring surrounds each eye. The spot above the carpal joint is white, rather than black as in the other animals. Their horns are up to about 40 cm. long and some 22 cm. in circumference at the base, both longer and more massive than those of females (Plate 2).

DISTRIBUTION AND NUMBERS

The Nilgiri tahr is known only from the hills of southern India, ranging 'from the Nilgiris to the Anaimalais and thence southwards along the Western Ghats . . .' (Prater 1965). Unlike the Himalayan tahr which lives for at least part of the year among brushy ravines and on forested slopes (Garhwali 1911), the Nilgiri tahr prefers open terrain, cliffs and grass-covered hills, a highly discontinuous habitat largely confined to altitudes of from 1200 to 2600 m. Tahr probably occupied all suitable areas in the past, but hunting and habitat destruction have decimated them to such an extent that they now exist only in a few isolated sites. I was not able to check all possible tahr localities in the short time available to me, and, instead, devoted most effort to censusing the animals in the two main areas where they occur, devoting 15 field days to the Nilgiri Hills of Tamil Nadu (Madras), and 19 days to the High Range of Kerala. Two days were also spent in the Anamalai Hills in Tamil Nadu, but for information on other areas I depended on correspondence with local sportsmen and tea planters.

Nilgiri Hills. The Nilgiris rise abruptly from the plains to a lofty tableland some 1800 sq. km. in size. The lower slopes are densely covered with forest, particularly with wet evergreen forest on the Western side, surmounted often by sheer granite cliffs towering to the plateau above (Plate 1). The uplands consist of a large expanse of steeply rolling hills at an altitude of about 2000 m. Grass covered most of the hills in recent times, except for patches of stunted evergreen forest, the 'sholas', confined to ravines and sheltered slopes. But in the past few years most of the area has either been cultivated or converted into wattle and *Eucalyptus* plantations. It is probable that forests covered much of the plateau in the past, with grasslands only in boggy hollows and on steep slopes. Annual fires during the dry seasons in January and February and grazing by domestic buffalo belonging to the original inhabitants, the Todas, pushed back the forests slowly (Jeyadev n.d.) until only patches of it remained when the first Europeans penetrated the areas between 1812 and 1819 (Fletcher 1911).

'In former times, that is about fifty years ago, the Ibex appears to have roamed at will in vast herds over all the grassy uplands of the higher plateau of the Nilgiris . . .' (An Old Shikarri 1880). By 1879, however, hunting had reduced the tahr to such an extent that their number 'probably did not exceed a dozen head all told' according to Phythian-Adams (1939). This estimate may be too low for Russell (1900) found herds readily in 1886 and 1888. By the end of the century the tahr survived largely along the western edge of the plateau, an area remote from human habitation where the huge cliffs and inclement weather (up to

750 cm. of rain a year) protected them from the casual hunter. In addition, the Nilgiri Wild Life Association, formed in 1877, interested itself in the species and afforded it protection. By 1927, about 400 tahr were thought to exist in the western Nilgiris (Phythian-Adams 1927), and by the late 1930's 'not less than 500' (Phythian-Adams 1939). The Nilgiri Wild Life Association conducted the first census of the tahr in 1963. The area in which they occur was divided into 4 sections and 4 teams of 2 men each counted the tahr over a period of 4 days (Davidar 1963a). 'The tahr actually seen and counted amounted to 292 . . . So it can be safely estimated that there are about 400 tahr in the Nilgiris . . .' (Davidar 1963b). The various figures suggest that the size of the tahr population had remained relatively stable or declined only slightly in the past 40 years, although a few small herds, such as one near Glen Morgan (Davidar 1963b), had disappeared. Davidar, however, wrote to me in March, 1970 : 'I have been chasing them . . . for the last 16 years and I can assert with certainty that they have increased during this period.'

Most tahr in the Nilgiris inhabit the western escarpment from Nilgiri Peak south to the Bangitappal and Sispara Pass area, a continuous stretch of terrain about 37 km. long (Fig. 2). I spent a week searching for tahr in the northern third of this range, between Nilgiri Peak and Pichal Bettu, and found a total of 63 different animals. The tahr confined their activity to the cliff faces and grasslands immediately adjoining them, a strip 1 km. or less in width, as indicated by repeated sighting of animals or their sign such as droppings and resting places. It is thus unlikely that any large herds were overlooked. In the census conducted by Davidar (1963a) a total of 79 tahr were recorded in the same area. I did not visit the central third of the tahr's range, but Davidar (1963a) found 66 animals there.

The hills along the southern third of the escarpment are rockier and more rugged than those farther north with the result that an area of about 50 sq. km. has remained free of forest plantations. A week of searching along all bluffs and major ridges revealed a total of 113 tahr, as compared to 112 reported by Davidar (1963a) from the same area. Most animals were along the escarpment where they were easy to spot, but a few small herds were inland as well. Considering the excellent visibility and the fact that in all cases except one a herd was located after finding fresh sign, it seems likely that the count was fairly complete. A small population of about 35 animals existed near the Chembar River slightly to the east of the Sispara area in 1963 according to Davidar (1963a). I did not visit the site.

The similarity in the 1963 and 1969 counts in 2 areas indicates that the tahr population has remained stable during the past 6 years and numbers about 300 animals in the Nilgiris as a whole.

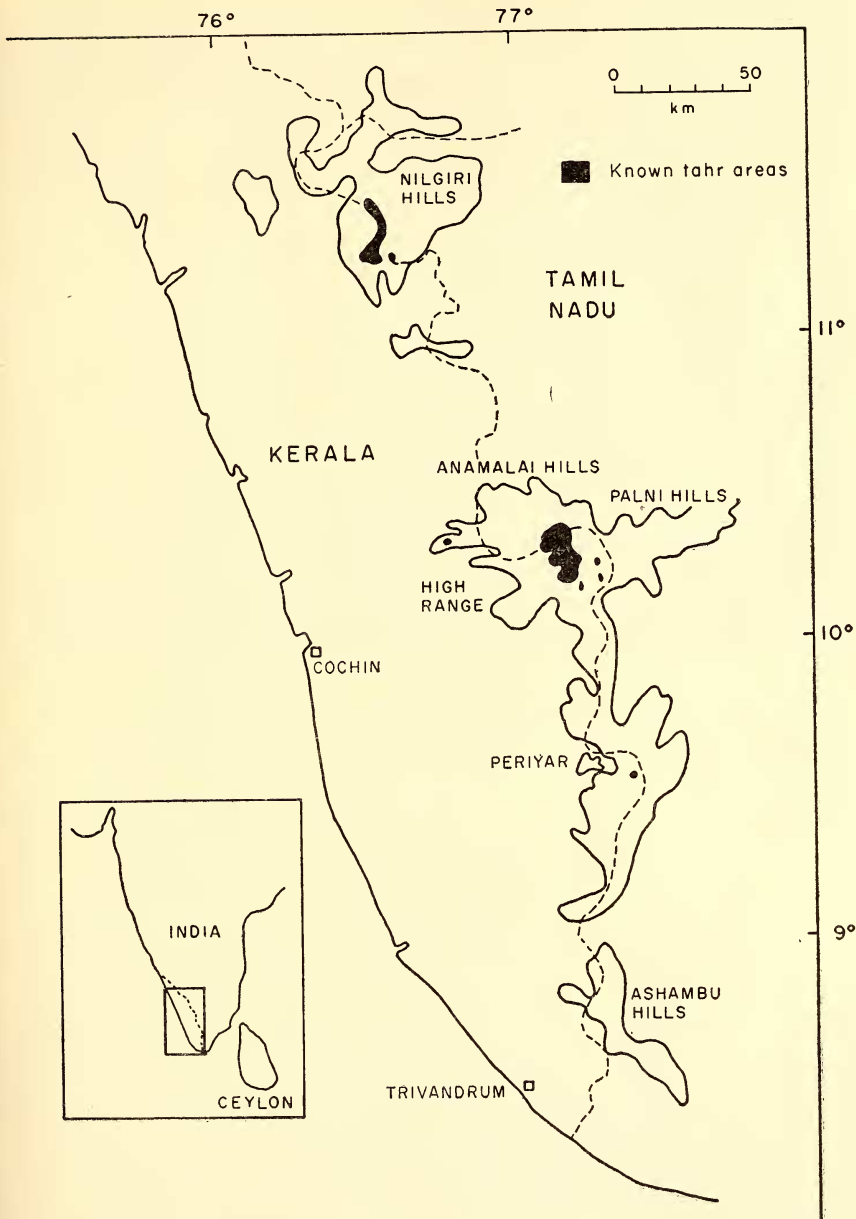


Fig. 2. The hill ranges of south India, drawn along the 1000 m. contour line showing the precise locations at which tahr were seen in 1969 or known to have occurred in 1967 and later. Other small populations existed in the Anamalai and Palni hills and possibly elsewhere but it was not possible to obtain detailed information on these in the time available for the survey.

High Range. A gap of about 100 km. separates the tahr in the Nilgiris from those in the High Range and Anamalai Hills to the south. The High Range with its deeply dissected valleys, massive peaks, and towering crags is 'surpassingly grand, and incomparably beautiful', in the words of Hamilton (1892), one of the first visitors to the area in 1854. Tea plantations now cover the valleys, leaving indigenous forests only on the steep slopes, but the cliffs and grassy plateaus above an altitude of 2000 m. still provide suitable tahr habitat. The Eravikulam area, also known as Hamilton's Plateau, a private shooting reserve owned by the Kanan Devan Hills Produce Company, contains the largest tahr population in the High Range (Plate 1). Protected from poachers, pastoralists, and agriculturalists since 1895 by the High Range Game Preservation Association, as well as by the cliffs that border the 80 sq. km. plateau on 3 sides, the tahr there have remained relatively undisturbed in recent years. Fire and slash-and-burn cultivation by the Muduvars, who occupied the area sometime after the 14th century (Thurston 1909) are probably responsible for the little forest that is left on the plateau.

The Eravikulam area, including Rajamallay and Anamudi Peak, was divided into 7 blocks for census purposes. Each day I searched for tahr along all cliffs and ridges in one block. Visibility in the open, undulating hills was so good that animals were sometimes seen with binoculars or spotting scope from 1 to 2 km. away. Only the clouds which usually settled against the cliffs by noon hampered the census work. Undisturbed herds moved little from day to day, making it unlikely that animals were counted twice by shifting from one block to another. However, disturbed herds may flee as far as 3 km. without stopping, and care must be taken not to duplicate such animals in a count. A total of 439 tahr were seen. In addition, fresh sign indicated the presence of another herd but I was unable to find it in the clouds that engulfed the hills at the time. The total number of tahr in the reserve was thus about 500.

Mr. Gouldsbury told me that small herds of a dozen or so each occur on Tertian's Plateau, Karinkulam, and Periaurrai. All 3 localities are small plateaus separated only by a valley from each other or from the Eravikulam Reserve.

Anamalai Hills. The Anamalai Hills border the High Range to the north without an intervening physical barrier. Hawkeye (1881) saw tahr in these rugged, grass-covered hills in herds of hundreds and Hornaday (1885), too, found them 'quite abundant'. In 2 days of searching for tahr within an area of some 40 sq. km. bordering the Eravikulam Reserve, only one herd numbering about 25 animals was seen. Human disturbance in that area is great and includes a road, tree plantations, and, according to my guide, much poaching. K. Mathew, Divisional Forest Officer, told me that a number of tahr occurred in the Parambikulam

Schaller : Nilgiri Tahr



Above: Typical tahr habitat in the north-western part of the Nilgiri Hills. *Below:* The Eravikulam Reserve in the High Range as viewed from Anamudi Peak. The distant ridge lies in the Anamalai Hills. Tahr remained mainly along the cliffs such as those in the foreground.

(Photos : Author)

Schaller: Nilgiri Tahr



Above : Nilgiri tahr watching the observer alertly. In the centre is an adult female; the animals on the right and left are yearlings almost 2 years old. *Below* : A saddleback male grazes on a steep slope. His grey saddle, the greyish neck, and spot above the knee are clearly visible.

(Photos : Author)

Sanctuary in the western part of the Anamalais in 1967. R. Steele, a tea planter, wrote to me that tahr could still be seen in several areas in the hills.

Palni Hills. H.H. the Raja of Pudukkotai noted that 'there are still a few Nilgiri Tahr left in the Palni Hills, may be there are about a 100 to 150 on the whole roaming about the cliffs' (letter, 1970). I was unable to obtain more information through correspondence and my time was too limited for a visit to the area.

Other areas. Tahr probably occurred as far south as the Ashambu Hills in the past¹. A few animals possibly survive in the Periyar Sanctuary and surrounding areas. K. Mathew told me that tahr were wiped out in the sanctuary, but M. C. Jackson, a tea planter at Vandiperiyar, wrote that a friend of his encountered 2 tahr there in 1967.

Summary. A total of 640 tahr was seen during the visit to south India and other information raised the known number of animals to at least 1000 of which 300 were in the Nilgiris, 530 or so in the High Range, and most of the remainder in the Anamalai and possibly the Palni Hills. However, a precise estimate of the total number of Nilgiri tahr surviving in the wild cannot be made until the status of the species has been determined in the Anamalai and Palni Hills as well as in the region lying to the south of the High Range.

POPULATION DYNAMICS

While censusing, each herd was counted and when possible classified into adults (2 years old and older), yearlings (1 to 2 years) and young (0 to 1 year). Adult males were divided into 3 age classes according to size and pelage colour : saddlebacks, dark brown males lacking a saddle, and light brown males of the same size and colour as females. Himalayan tahr can be accurately aged by the conspicuous growth rings on the horns which are laid down each winter other than the first (Caughley 1965). Rings were not readily discernible on free-living Nilgiri tahr, but 6 mounted heads, which judging by horn size belonged to dark brown males or saddlebacks, all had 5 to 7 faint growth rings. There is, of course, no evidence that the Nilgiri tahr grows one ring a year like its Himalayan relative, but I would assume that such males are at least 5 years old. Yearlings, which at the time of the study were almost 2 years old, were about 1/4 to 1/3 smaller in size than an adult female and their horns were

¹ In April, 1970, J. C. Daniel of the Bombay Natural History Society visited the hills south of the High Range and was told by various informants of 14 localities where tahr are still said to occur.

more slender than those of adults. Most young, nearly one year old, had straight or slightly curved horns some 7 to 12 cm. long.

POPULATION COMPOSITION. Of 176 tahr seen in the Nilgiris, 164 were classified. One herd of 7 disappeared in fog before I could find out the age and sex of the animals, and 6 others separated from a large herd during a count. I was unable to classify all animals in the High Range, except the dark brown males and saddlebacks. The figures for light brown males, females and subadults are, therefore, based on a sample of herds totalling 260 tahr.

In the Nilgiris, 21% of the population consisted of adult males of which 9% were saddlebacks (Table 1). Adult females comprised 34%

TABLE 1
COMPOSITION OF THE TAHR POPULATION IN THE NILGIRIS AND HIGH RANGE

Sex and Age Class	Nilgiris %	High Range %
Saddleback	9.1	11.0
Dark brown male	4.3	4.2
Light brown male	7.9	4.2
Adult female	34.2	33.6
Yearling	18.9	17.3
Young	25.6	29.6

and subadults (yearling and young) 45%, indicating a vigorous population with good reproduction. The figures for the High Range were similar to those of the Nilgiris with adult males at 19%, of which 11% were saddlebacks, adult females at 34%, and subadults at 47% (Table 1). If it is assumed that dark brown males and saddlebacks are over 5 years old and that there are at least as many adult females of similar age in the population, then 25-30% of all animals were 5 years old and older and 25-30% were 2 through 4 years old. Female Himalayan tahr in New Zealand may reach an age of 17 years though only 3% exceed 12 years (Caughley 1966). The ratio of 2 males to 3 females indicates either an unequal sex ratio at birth or a higher death rate among males than females at some time during the life cycle. I was unable to sex most young with precision, but a count of 31 yearlings in the Nilgiris, for example, showed that 11 were males and 20 were females. Although these figures do not differ statistically in a significant manner from a 1 : 1 ratio, they do suggest that more females than males may already be present among

subadults. Phythian-Adams (1927) found that 'the does outnumber the bucks by some 20 to 1', but he does not give the basis for his statement.

REPRODUCTION. Published information on the reproductive biology of the tahr is confusing. Stockley (1928) noted that 'kids may be dropped at any time of the year', and An Old Shikarri (1880), Willet (1968) and others made similar statements. On the other hand, Kinloch (1926) and Prater (1965) wrote that most young are born at the beginning of the hot weather, presumably in March, and Lydekker (1898) stated that parturition is in June and July. If births occur throughout the year, then young of all sizes would be expected in the population. Of 133 young classified (and many other seen) all but three were of approximately the same size, indicating a sharp birth peak. The young were large, with conspicuous horns up to 12 cm. long, and many adult females were heavily pregnant in November. From this evidence, I would judge that most young are born during the cool season between December and February. One young in the Nilgiris was less than a month old in October and another was perhaps 2 months old, indicating that occasional births occur in other months as well. With a birth peak from December to February and a gestation period of 6 months (Fisher *et al.* 1969), the main rut would be in June, July, and August, mostly during the south-west monsoon, rather than in December and January as stated by Stockley (1928).

The Nilgiri tahr has 2 teats (unlike the Himalayan tahr which has 4, two of them rudimentary). Stockley (1928), Kinloch (1926), Prater (1965) and others noted that one young is the rule, and this was my impression too. Sterndale (1884), on the other hand, stated that tahr usually have twins. Yearling females were not visibly pregnant at the age of nearly 2 years, suggesting that most tahr had their first young at the age of 3 years.

MORTALITY. Generally the per cent of yearlings entering the adult class of a stable population roughly equals the per cent of adults disappearing through death or emigration. About 18% of the tahr comprised yearlings (see Table 1). The Nilgiri population was thought to have remained stable in the past years, and the High Range one showed no striking fluctuations during the 1960's although Gouldsbury (pers. comm.) felt that it was increasing slowly. Thus, in the Nilgiris at least, annual adult mortality might be as high as 18%. Mortality of young was low. Assuming that each adult had one young early in 1969, then 76% of the females in the Nilgiris and 88% in the High Range raised one offspring almost to the age of one year. If production and survival of young was as high in 1968 as in 1969, then the difference between the percent of yearlings and young gives an indication of mortality between the two age

classes. The Nilgiris showed a 44% drop in number, the High Range 27%. Although these figures are based on several assumptions, they do suggest that many yearlings and perhaps as many as 1/6 of the adults die each year, there being no evidence of large-scale emigration. Possible causes of death include disease and predation.

Disease. No sick tahr were seen. Rinderpest is said to have decimated the High Range population long ago (Gouldsbury, pers. comm.), and lame animals are sometimes encountered in April, a time of year when foot-and-mouth disease is prevalent in local cattle, according to my guide, a tribal Muduvar. The remains of only one tahr, an adult female, were found in many miles of hiking. However, sick animals probably retreat to the cliffs and fall into the dense brush below when they die.

Predation. Tahr share their habitat with several potential predators. Jackal (*Canis aureus*) possibly kill newborn young on occasion. To obtain some idea of jackal food habits, 119 sets of droppings from the High Range were examined and the results in Table 2 show that small

TABLE 2
FREQUENCY OF OCCURRENCE OF FOOD ITEMS IN 119 JACKAL DROPPINGS,
HIGH RANGE

Food items	Frequency of occurrence (%)
Small rodent	94.4
Lizard and snake	29.4
Crab	10.0
Insect	6.7
Seed	5.8
Sambar	2.5
Hare	0.1
Snail	0.1

rodents provided most food during October and November. The sambar hair in the droppings undoubtedly represented carrion. Thyagarajan (1958) once observed wild dogs (*Cuon alpinus*) hunt tahr and on this basis assumed that predation is 'the most important factor operating against their survival'. Wild dogs are rare, however, and packs visit an area only at long intervals. Observers both in the Nilgiris and High Range told me that sambar (*Cervus unicolor*), not tahr, are the main prey of wild dogs in the hills. Davidar (pers. comm.) once watched a leopard (*Panthera pardus*) stalk tahr unsuccessfully. I saw only one set of tracks of this uncommon cat. One tiger (*Panthera tigris*) frequented the Bangitappal area of the Nilgiris and two the Eravikulam Reserve during

my visit. All 10 tiger droppings which I found contained sambar remains and one also crab shells. In sum, all these predators are now rare to uncommon, and there is no evidence that they have any controlling influence on the tahr populations.

Saddlebacks may be legally hunted but only a few are shot each year. The average annual kill in the Nilgiris between 1912 and 1938 was 4·6 (Phythian-Adams 1939) and between 1940 and 1966 it was 2·3 (Davidar 1968). An average of only 1·9 animals per year were shot in the High Range between 1958 and 1969. Hamilton (1892), who in 1854 was the first European to hike through the Eravikulam area, found that tahr 'were extremely wild, which was accounted for from their having been lately harassed by hill men, the Moodowas, who had constructed across one of their runs, a barrier of stout bushes, forming a strong hedge, with weak places ten or twelve feet apart ; across which a strong running noose was firmly secured. The ibex were then driven up to these barriers and were ruthlessly snared and shot.' Hawkeye (1881) and Thyagarajan (1958) describe similar methods of killing in the Anamalai Hills. Illegal hunting has undoubtedly been responsible for the extirpation or drastic reduction of tahr in most of their former habitats, and the remaining populations are still subjected to a certain amount of it. Recently, for example, a High Range police official shot 2 tahr that had come near a road, and Davidar told me that several poachers were encountered in the Bangitappal area shortly after my visit there.

This discussion about possible causes of mortality provides little precise information about the factors which actually influenced the tahr populations, and it is obviously important to monitor the animals throughout the year to find out if disease, for instance, affects them at certain times.

HERD STRUCTURE

Tahr are social animals which usually associate in groups of two or more individuals. One adult female was seen alone as were 3 different dark brown males and 5 saddlebacks, but such animals were uncommon. Groups can be divided into mixed herds, consisting of females and sub-adults, and, on occasion, also of males, and into male herds composed solely of males.

Herd size. My observations, as well as those in the literature, indicate that tahr seldom occur in mixed herds exceeding 50 individuals. Sterndale (1884) mentioned herds with 60, 65, and 120 animals, Kinloch (1926) with 60 and 90, and Fischer (1915) one with at least 86. Twenty-three mixed herds counted during the census work varied in size from 6 to 104.

animals with an average of 23 (Fig. 3). A total of 9 different male herds were tallied, and these varied from 2 to 12 animals each with an average of 5.5.

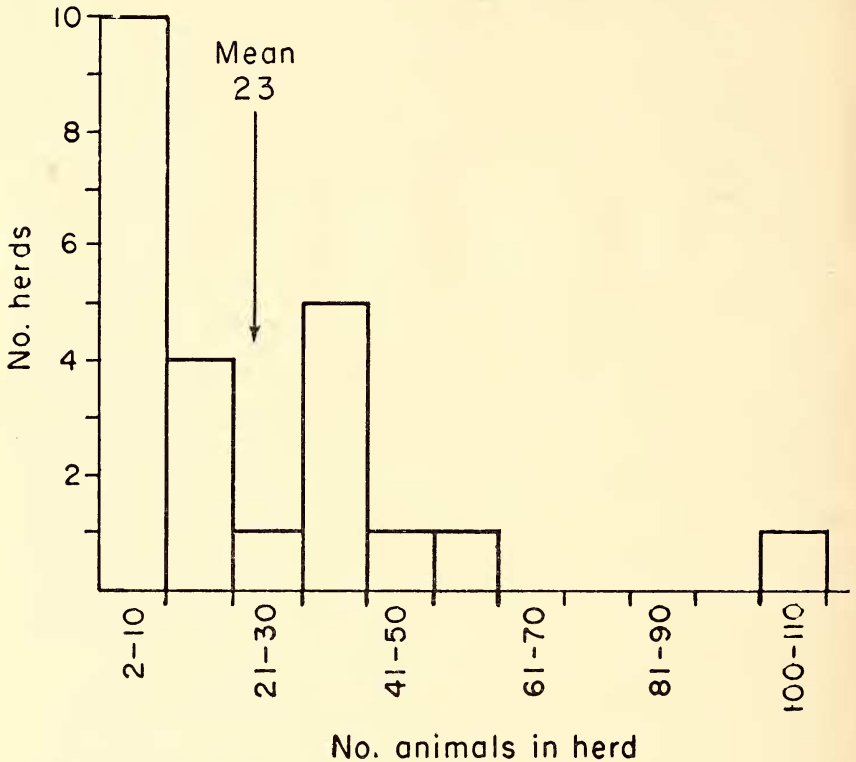


Fig. 3. The size of 23 mixed tahr herds.

Herd composition. Mixed herds characteristically contain light brown males, females, and subadults, but dark brown males and saddlebacks are only sporadic members (Table 3). At the time of my study, some large young and yearlings tended to form their own group, remaining either at the periphery of a mixed herd or becoming widely separated from it. For example, one herd consisting of a yearling female and 5 young was at least 3 km. from the nearest adults. Young also left their mothers and attached themselves to other animals when herds split with the result that some contained 2 to 3 times as many young as adult females whereas others had few or no young.

Tahr herds may change in composition from day to day as they split and join without obvious pattern. For instance, one herd of 34 was joined by 2 dark brown males and 3 females in the course of a day. A herd of 43 split into herds of 16 and 27. When encountered again the following day 38 animals were together. Of these a saddleback left

alone, 29 crossed a deep valley, and 7 females and a light brown male moved in the opposite direction.

TABLE 3

COMPOSITION OF SOME TAHR HERDS IN THE NILGIRIS AND HIGH RANGE

Male				Female			
Saddleback	Dark brown	Light brown	Yearling	Adult	Yearling	Young	Total
2		1	1	2			6
					1	5	6
				2		6	8
2				3		3	8
1		2	1	6		4	14
		1			4	10	15
		2	3	12	7	10	34
1	1	2	2	17	3	8	34
1	1	6	1	16	4	9	38
1	2	3	5	12	7	9	39

Dark brown males and saddlebacks enter and leave mixed herds intermittently on their own volition. When not in a mixed herd such males are alone or in male herds (Table 4). In the Eravikulam area the

TABLE 4

COMPOSITION OF SOME MALE HERDS IN THE NILGIRIS AND HIGH RANGE

Saddleback	Dark brown	Total
2		2
3		3
	2	2
3	3	6
7		7
4	5	9
9	3	12

males tended to congregate. Whereas mixed herds were scattered along the cliffs, 30 of the 69 dark brown males and saddlebacks in the reserve were in the western corner. The fact that males leave mixed herds has been noted frequently (Hamilton 1892 ; Willet 1968), but opinions differ as to the season when they do so. Stockley (1928) felt that the separation occurs in the cold season and Kinloch (1926) that it happens in the hot season. Each dark brown male and saddleback seen in the Nilgiris and High Range was classified according to whether he was alone, in a male herd or in a mixed herd. Table 5 shows that during the first half of

TABLE 5
PER CENT OF MALES SEEN ALONE, IN MALE HERDS, AND IN MIXED
HERDS DURING OCTOBER

Date	No. males in sample	% males alone	% males in male herds	% males in mixed herds
Sept. 30-Oct. 16 ..	31	19	29	52
Oct. 17-31 ..	75	9	72	19

October, when I worked in the Nilgiris, about half of the males associated with mixed herds, and that during the second half, when I was in the High Range, over 3/4 of the males were alone or in male herds. My sample for November is too small to include in Table 5, but only one of 9 mixed herds contained a dark brown male or saddleback. The largest males in an ungulate population usually do most of the mating (see Geist 1966 ; Schaller 1967), and the highest per cent of dark brown males and saddlebacks would, therefore, be expected around mixed herds during the rut from June to August. Afterwards, when few females come into oestrus, the males associate only casually with them. Mixed herds which one day included a saddleback frequently lacked one the next day, confirming the transitional nature of the contacts. Anderson & Henderson (1961) found that 'apart from the rutting season, which extends from late April to early July, the sexes range separately' in the Himalayan tahr of New Zealand. Transitional contacts between mixed herds and males are also found in many other species of hoofed animals such as the gaur (*Bos gaurus*) and axis deer (*Axis axis*) in India (Schaller 1967), the ibex (*Capra ibex*) in Switzerland (Nievergelt 1967), the wild goat (*Capra hircus*) in Pakistan (Roberts 1967) and the bighorn sheep (*Ovis canadensis*) in Canada (Geist 1968).

Light brown males, estimated to be 2 to 4 years old, did not become solitary or join male herds, in contrast to young *Capra ibex* males which may join male herds at the age of 2 and 3 years (Nievergelt 1967).

BEHAVIOUR

The behaviour of undisturbed tahr was observed for 53 hours, often from 1 km. or more away to reduce the chances of being detected by the animals. However, the erratic winds frequently carried my scent to them, and this, together with clouds that often obscured the cliffs, made prolonged observations difficult. Nor were October and November the most auspicious times for recording behaviour. The bonds between females and their young were essentially broken, and the rut was finished. For example, my observations on sexual behaviour were limited to males twice sniffing the vulva of urinating females and curling their lip up afterwards.

General behaviour. Fletcher (1911) and other observers stated that tahr are active mainly in the early morning and late afternoon, but Kinloch (1926) also found them feeding at midday. An Old Shikarri (1880) noted that they are active at all hours, an observation which agrees with what I saw. Herds gave the impression of being restless as feeding and rest periods of varying lengths followed each other. Frequently one animal in a herd began to graze and all others joined within 10 minutes. They remained active for perhaps 30 to 45 minutes and then lay down again one at a time. To find out if tahr follow some general daily pattern of activity, I recorded the number of animals grazing and not grazing every 5 minutes in each undisturbed herd. The 6 points in each 1/2 hour period were lumped and expressed as per cent of animals feeding in Fig. 4 which is based on 10,968 activity observations. Most tahr fed until about 08.00 hours. There was a sharp drop in activity between 08.00 and 08.30 hours and then about 2/3 of the animals rested at any one time until 10.30 hours. After that and until 14.30 hours at least half the tahr fed, followed by a slight drop in activity between 14.30 and 15.30 hours. A second feeding peak occurred after 16.00 hours. Phythian-Adams (1950) stated that tahr remain on the cliffs at night.

In October and November, when green forage was plentiful throughout their habitat, the tahr fed mostly on or near cliffs. Grazing herds moved either as a fairly compact unit or loosely scattered over the slope. Occasionally they travelled to another site in single file with an adult female in the lead and saddlebacks usually in the rear. The animals were silent except on one occasion when I heard several bleats. Green grass was the tahr's principal food during the period of study. In addition the leaves of a shrub (*Strobilanthes kunthianus*), of an Umbelliferae (*Heracleum* sp.) and a wattle (*Acacia* sp.) were also eaten. Between January and March, after the dry grasses have been burned and before the first April showers produce a growth of new grass, tahr are said to

browse along the edge of the thickets and the bases of the cliffs. Some patches of soil on steep slopes had been extensively pawed by tahr and these possibly represented saltlicks.

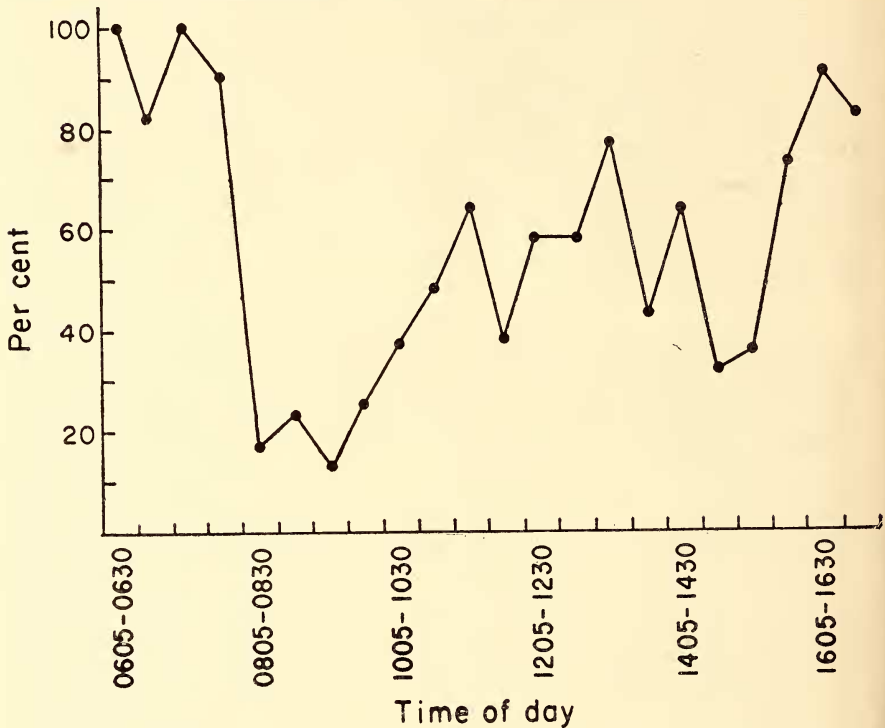


Fig. 4. Per cent of tahr grazing at various times of day, 06.00 to 17.00 hours.

Herds usually rested along the rim of the escarpment or on the cliff ledges. They reclined either with legs tucked under the body or more often with one or both forelegs stretched out in front of them and sometimes with the hindlegs extended to one side as well. Many chewed cud, at the rate of about 3 chews per 2 seconds. Occasionally one rose and scratched its head or neck with a hindfoot or its upper back with a tip of the horn.

Undisturbed herds remained in the same area for long periods. A herd encountered on a cliff one day could usually be found in the general locality or even in the same spot on subsequent days. One population of about 135 tahr, divided into 3 or more herds, was always found along the same 5 km. stretch of cliffs between October 22 and November 12. Female Himalayan tahr have distinct home ranges (Caughley 1966). Gouldsbury told me that tahr wander away from the precipices in search of food during the dry season and that they tend to take shelter from the high winds and lashing rain on the eastern side of the plateau during the south-west monsoon. The casual joining and parting of animals

and the readiness with which herds flee long distances into terrain occupied by others indicates that tahr have no territory in the sense of an area exclusively used by a group or individual, at least during October and November.

Agonistic behaviour. Aggressive contacts between animals were uncommon. Sometimes one hooked another lightly with a horn when the herd was bunched up after a disturbance. On 6 occasions a tahr walked to a reclining one, jabbed it with a horntip in the flank, and, after it moved, appropriated the resting site. Five of these instances involved a female replacing a young and one a light brown male replacing a yearling male. On 2 occasions, when a yearling male jabbed a yearling male and a light brown male, respectively, the recipient did not relinquish its resting place.

Fights between two tahr were observed 53 times. Eighteen (33%) of these involved the side butt. The animals stood parallel and facing the same direction and in unison jerked their head sideways rapidly once or twice thereby clashing their horn against one of the opponent's. They were never seen to push with shoulder and hips in such situations as feral goats do (Geist, pers. comm.). The head-on butt was used in 22 (42%) of the interactions observed. Two tahr faced each other, a metre or less apart, lowered their heads abruptly and one or both lunged so that the horns met with a crash. Usually one of the combatants struck predominantly with one horn while the other caught the blow between his horns, a method of striking also used by American mountain sheep (Geist 1966). Most contacts were brief, one or two clashes, and were seldom preceded or followed by other interactions. On one occasion a light brown male mounted a saddleback before they fought, in contrast to bighorn sheep where the dominant characteristically mounts a subordinate one (Geist 1968).

The shoulder push was used in 13 (25%) of the fights observed, and the actions were more prolonged than the other types of combat. Two animals characteristically stood parallel and facing in opposite direction, then pushed each other, shoulder to shoulder, often circling rapidly as they did so. Once two males kneeled and circled in a fighting pattern reminiscent of that used by zebra (*Equus burchelli*) as described by Klingel (1967). As the animals turned, they jabbed each other gently or vigorously in the side, flank or occasionally the abdomen with the tip of one horn. Sometimes they stopped, faced each other and butted head-on before circling again. Twice one animal hooked the other into the lower part of the neck during a pushing interval. Occasionally a tahr pawed the ground with a foreleg before or after the fight or assumed the hunch posture (see below). This method of fighting is similar to one described by Geist (1964) in the American mountain goat (*Oream-*

nos americanus) : 'They fight keeping side by side while moving about one another. Goats, strike up and sideways with their head, driving the horns into the opponent's body region.'

The fourth type of combat, rearing up, was not observed in its full form during the study, possibly because it is used primarily by males during the rut. Hutton (1947) saw one fight on August 3 : A young male stamped his forefeet when approached by a saddleback. They looked at each other from a distance of about 10 m. and both stamped their forefeet and nodded their heads. Then 'the two animals almost simultaneously reared up on their hindlegs and seemed to "dance" in front of each other, while keeping their distance and circling. Suddenly they would close in and bring their heads together with a resounding crack'. After half an hour of combat the saddleback rammed the other male in the shoulder thus ending the fight. He then approached a female and mated with her. On one occasion, a light brown male kneeled on his forelegs and rubbed his horns in the grass with lateral motions. Suddenly he reared up on his hindlegs with his chin tucked in and turned slightly to one side and the forelegs drawn close to the body. Facing him was another light brown male with his head averted. On another occasion, a female snorted and lunged at another female with both forelegs off the ground in a manner similar to that used by fighting mountain goats (Geist 1965).

The type of fighting, as well as the frequency with which each type was used, varied with the age and sex of the tahr (Table 6). Males, females and subadults all butted from the side or head-on, both with animals of their own age and sex and with others. The shoulder push

TABLE 6
NUMBER OF ANIMALS IN EACH SEX AND AGE CLASS INVOLVED IN VARIOUS
TYPES OF FIGHTING, BASED ON 106 COMBATANTS

Sex and Age Class	Approx. composition of mixed herds in %	Side butt %	Head-on butt %	Shoulder Push %
Saddleback and d.b. male ..	5	8.3	0	3.8
Light brown male ..	6	5.6	29.5	34.6
Female ..	38	41.7	13.6	0
Yearling ..	20	36.1	43.2	61.5
Young ..	31	8.3	13.6	0

was not observed among females and young, and of 16 sexed yearlings involved in that type of combat all were males. Either the larger or the smaller of two participating males initiated the shoulder push. Once, for instance, a yearling jabbed a light brown male repeatedly in the side, abdomen and flanks before the latter responded, and they then circled shoulder to shoulder. On another occasion, a light brown male initiated the fight with a yearling male. Dark brown males and saddlebacks fought seldom, but light brown males were involved in head-on butts and shoulder pushes (but not side butts) much more frequently than would be expected from their number in the population. Females side-butted as often as expected but used the head-on butt little and shoulder push not at all. Yearlings fought often by all three methods and young seldom. A ranking of the classes based on the relative frequency of fighting would place light brown males at the top, followed in decreasing order by yearlings, females, dark brown males and saddlebacks, and young.

Two additional kinds of behaviour were associated with aggression. On 8 occasions an animal was seen to rub its horns and face either up or down on a sapling or laterally on the ground, sometimes for as long as one minute. Two animals kneeled on their frontlegs while doing so. The behaviour occurred in 2 females, 3 yearling males, a dark brown male, and 2 light brown males, and only in the last was it seemingly directed at a particular individual. In one of these instances, the male rubbed his head on the ground in front of a reclining saddleback. He then jabbed the saddleback in a hindleg, wedged a hoof between the horns and pulled. The saddleback ignored the gesture. Rubbing in tahr appeared to be analogous to similar behaviour among deer, such as the wapiti, *Cervus canadensis*, (Struhsaker 1967) and antelope, such as the grant's gazelle, *Gazella granti*, (Walther 1965). The actions undoubtedly leave both visual and olfactory signals of the animal's presence in the environment.

A conspicuous posture termed the 'hunch' was observed 16 times, twice in females, the others in yearling and adult males. The animal hunched its back and arched its neck down, sometimes with the nose merely pointing forward but often with it perpendicular and almost touching the ground or pointing back between the legs. The ears were laid back, and the animal walked or trotted with a stiff gait, the legs bunched beneath the body. This display is strikingly similar to one described by Geist (1965) in the mountain goat: 'The male erects itself by stretching front and hind legs until they are straight and stiltlike. The back is arched upwards; the belly is drawn in; the neck is arched down...' Occasionally a tahr displayed in no particular circumstance or it briefly combined the behaviour with other patterns. One dark brown male, for example, separated by 60 m. from the herd, hunched

his back, then rubbed his horns in a shrub. The hunch is also seen during interactions between males. Once two light brown males met on a narrow ledge. Each arched its back before pushing gently with the shoulders. On other occasions a light brown male approached a yearling male in a hunch before they butted head-on, and two yearling males walked parallel and 5 m. apart in a hunch after fighting. One dark brown male approached a reclining saddleback with his back arched. The saddleback rose and walked broadside slowly past the other male in a hunch, displaying his striking profile. The hunch makes the animal conspicuous, and it may be hypothesized that it serves to intimidate an opponent, that it is a substitute for fighting, similar to the displays described in numerous other hoofed animals (Walther 1960/61; Geist 1966; Schaller 1967).

Paleontologists suggest that the caprids evolved from rupicaprids of which the American mountain goat and serow (*Capricornis sumatraensis*) are living examples. The tahr appear to be a link in many physical characters between the two groups, as Geist (in press) has pointed out, and various aspects of their agonistic behaviour are thus of interest when compared with *Capra* on the one hand and with the rupicaprids on the other. 'Mountain goats do not fight head to head...' (Geist 1964), but tahr and *Capra ibex* (Nievergelt 1967) do so. On the other hand, the distinctive shoulder push of the tahr has not been described for *Capra*, although feral goats push with shoulders and hips when standing parallel (Geist, pers. comm.), but mountain goats possess an analogous pattern in which they circle and jab the opponent around the ventral region. Tahr also rear up on their hindlegs, a typical method of fighting in such goats as *Capra ibex* (Walther 1960/61a) and *Capra falconeri* (Roberts 1969). This behaviour does not occur in the mountain goat (Geist 1964). Lateral displays of one form or another are found in antelopes, deer, gaur, and other hoofed animals on such diverse groups that the pattern is undoubtedly an old one in the evolution of aggression (Geist 1966). *Capra ibex* and *Capra falconeri*, too, show a lateral display (Walther 1960/1961b), although it is not well-developed, possibly because the large horns of these species have assumed the display function. The hunch of the tahr is so similar to the lateral display of the mountain goat that it suggests a rupicaprid origin. The Nilgiri tahr thus retain a number of distinct aggressive patterns which reflect their ancestry. Their method of butting is characteristic of sheep and goats in general, their pushing and hooking into the posterior part of the opponent as well as their lateral display point to a rupicaprid relationship, and their distinct way of rearing up is a typical caprid trait.

Anti-predator behaviour. Although I did not see tahr respond to predators, some of their reactions to my presence were probably typical

of their anti-predator behaviour in general. The preferred habitat of the tahr, the cliffs broken by grassy ledges, affords the animals protection from predators and it was probably for this reason that they were usually found near precipices and that their behaviour was oriented toward them. Mixed herds were encountered 44 times and 36 of these were on or within 0.5 km. of the cliffs bordering the Nilgiri and Hamilton's plateaus. Of the remaining 8 herds, 5 were on inland cliffs and only 3 were more than 0.5 km. from a precipice. Solitary males and male herds, too, frequented the vicinity of cliffs although they ventured inland more readily than did mixed herds. During one census, 14 out of 29 males seen singly and in groups that day were over 0.5 km. from a cliff, and on another day a herd of 12 rested on a gentle slope some 1.5 km. from the escarpment. Animals disturbed by man characteristically bunched up and ran to the nearest cliff. On three occasions, however, tahr left the protection of a cliff and fled across rolling terrain for two or more kilometres. While tahr on a cliff quickly detected the approach of a person below them, they were less alert to potential danger from above and it was often possible to creep close to them in that fashion.

'A sentinel is invariably posted to watch over the slumber of the herd...' (Fletcher 1911), and Kinloch (1926) and others made similar statements. The 'sentinel' is usually said to be a female. In 7 out of 24 resting mixed herds observed, one animal (5 females, 2 saddlebacks) stood or reclined conspicuously above the others and would have fitted the popular definition of sentinel. However, such animals achieved their isolated position usually by accident rather than choice. On two occasions a female reclined while the herd continued to graze. The other animals passed and finally rested on the slope below leaving a 'sentinel'. Of course, an animal in a prominent position is more likely to spot a potential source of danger before the others and it thus functions as a sentinel without the need to imply that the behaviour is purposeful. The general restlessness of herds also helped them to detect danger. With one or another animal almost constantly shifting position or grazing, it would have been difficult for a predator to approach undetected. Although tahr seemed to have good eyesight they used their acute sense of smell rather than vision to detect danger in most instances, and even if the source was clearly visible they sometimes verified it by scent before responding with flight. The animals often smelled me downwind at distances of from 200 to 300 m. On the other hand, I crept upwind on several occasions to within 10 m. of them while they were out of sight below the rim of a precipice, and once I walked slowly in full view to within 20 m. of a resting saddleback before the wind shifted and he scented me. On another occasion, 15 tahr came to within 20 m. of me as I reclined on an open slope. At first they whistled and stamped their

feet, but after several minutes some lay down and chewed cud seemingly oblivious to me. After 30 minutes the wind shifted and they bolted.

Tahr communicated the presence of danger to others by sound and by several gestures. If danger was imminent or obvious, tahr merely fled, an action which elicited similar behaviour in the rest of the herd. The alert posture with body held rigid as the animal stared with raised neck in a certain direction drew the attention of the others and they too then looked there. In addition two auditory signals enhanced the alert posture. One was foot-stamping. The tahr stamped a forefoot on the ground with a thump one or more times. Once a female leaped into the air several times in succession on the same spot and brought both forefeet down in unison after she detected me 50 m. away. A conspicuous signal was the whistle, described by Hamilton (1892) and others, a piercing sound made by expelling the air forcefully through the nostrils. Whistling was prevalent when tahr detected danger but seemed uncertain about its nature or location. Tahr seldom whistled after seeing or smelling me clearly, but they occasionally did so after a glimpse of me, particularly if I was upwind. Usually one or two members of a herd whistled in a particular situation. One saddleback, after detecting my presence 30 m. away in fog, gave 4 whistling snorts, sounds which seemed intermediate between the aggressive snort and the whistle. If one animal whistled, the others jerked to attention. For example, 33 tahr fled 30 m., looked around, then resumed grazing after one animal whistled once. On another occasion, 104 tahr rested on a slope. When one whistled, two-thirds of the animals leaped up. Members of one herd briefly looked around when hearing the alarm bark of a sambar nearby, but they did not respond to the 4 deer that walked through the herd, passing within 2 m. of some tahr, a few minutes later.

CONSERVATION

With possibly fewer than 1500 tahr in existence, 800 of them in two restricted localities, the species is in obvious danger of extinction. What can be done to insure its survival in the wild? Sometime in the future it would be desirable to stock tahr in the ranges once occupied by them, for, considering the slow and erratic rate of natural dispersal among wild goats under ideal conditions, it seems unlikely that tahr will recolonize their former habitats much today. But for the present, the most urgent task is the preservation of existing herds. The tahr in the Nilgiris, confined to a narrow strip of land along the western escarpment, have lost most of their habitat to forest plantations. Only the hills south of Bangitappal remain relatively undisturbed, and it would be commendable if the Tamil Nadu Forest Department reserved this road-

less area not only for the animals but also for visitors to enjoy. Roads have been or are being built into most parts of the tahr's range making access easy. Constant vigilance must be maintained to prevent poaching both by labourers in the plantations and hunters from the towns.

The Eravikulam Reserve in the High Range is a magnificent piece of hill country, an area which in some future year would make an excellent national park for those who like to hike, fish, and observe wildlife. The tahr there have for many years been managed well by the High Range Game Preservation Association, and it would obviously benefit the species to have this organization continue with its jurisdiction over the area.

The tahr is still shot on licence as a game animal in the Nilgiris and on special permission from the owners in the High Range. It might be argued that such a rare animal should be fully protected. However, as Davidar (1963b, 1968) has pointed out, the number of animals shot is negligible and to eliminate such hunting would actually be detrimental to the tahr. The animals survive in the Nilgiris and High Range only because the local wildlife associations have protected them for years for sporting purposes. In areas where tahr have not had the benefit of such private initiative, where they have had to rely solely on the protection afforded by the state government, they have either been wiped out or reduced to a few scattered herds. The revoking of shooting rights would eliminate whatever interest the wildlife associations have in the animal and the resulting increase in poaching and habitat destruction might well tip the balance of the species from tenuous security to extinction.

ACKNOWLEDGEMENTS

My visit to south India was sponsored by the New York Zoological Society. The Bombay Natural History Society, particularly Mr. J. C. Daniel, helped me in various ways. In south India I was particularly grateful to Mr. E. R. C. Davidar and Mr. J. C. Gouldsbury both of whom shared their extensive knowledge of tahr with me, received me most hospitably, and in general helped to make my visit rewarding and enjoyable. The Kanan Devan Hills Produce Company and the High Range Game Preservation Association generously permitted me to stay in their bungalow in the Eravikulam Reserve, and the Tamil Nadu Forest Department and Nilgiri Wildlife Association allowed me to visit the tahr in the Nilgiris. Dr. V. Geist kindly read the manuscript critically.